ELECTRICAL REVIEW

[ILLUSTRATED.]

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The Electric Light in its Moral and Social Aspect.

Among the many wonderful inventions, the electric light has, perhaps, proved one of the greatest boons that has been vouchsafed to humanity during the present century; as yet, it is but just entering upon its mission, but, even so, it has already passed that point where it has ceased to be a luxury simply, and now ranks as a necessity as well.

There is scarcely a city in the country in which it has not been, and all will testify to the comfort and pleasure which it has brought. Still more important, however, than these is the fact, which the records of the Police Department of this city most emphatically establish, that our personal security is enhanced with the growth of electric lighting.

Crime has no bosom for the bright rays of the mid-day sun, but revels amidst the shadows of night. The electric arc turns the night to day, tears off the cloak of darkness, and thief and thug skulk to their dens.

The New York *Graphic*, in a recent issue, has most aptly illustrated this point in a full page engraving which speaks for itself, and which we reproduce below.

This subject has before been frequently commented upon in the columns of the REVIEW, and the report of the Tenement House Commission made on January 14th last, gives occasion to revert to it again.

This report contains the very pertinent suggestion that the electric light in the poorer quarters of the city would be very beneficial in banishing crime. On those streets where gas has been supplanted by this system of illumination, burglary and garroting have been almost entirely stifled, and the thieves and blacklegs have abandoned these thoroughfares of lightness for those where the dim flickering gas jet still holds its sway.

"No one ever heard of a person being strangled by a burglar or clubbed by a robber under an electric light!" says the *Graphic*, and yet there are some who desire to debate, to the last penny, the question of its economy!

THE ELECTRIC LIGHT AS AN AID TO CIVILIZATION.

We do not compare the cost of gas with that of candles, nor the price of table claret with that of Veuve Clicquot; but when the light can be supplied, questions of its moral, social and hygienic adaptability, will determine its use, and not the question of price—although in New York city the price of electricity for street lighting is the same as that for gas of the same candle-power, and it is far lower than was that of gas in the early days of its introduction.

For interior illumination, gas is unhealthy, destructive and objectionable in many ways. When we consider that the ordinary gas jet will, without proper ventilation, soon render the air of a room unfit to breathe, and that the incandescent lamp does not in the least depend upon the atmosphere for its maintenance, whilst it radiates but one-seventeenth the heat of the gas flame, this in itself is sufficient to decide the issue.

It is a significant fact in connection with outdoor illumination by electricity, that those who have to shoulder the heaviest portion of the burden—the largest property owners and taxpayers—are its most earnest advocates, simply from the protection gained, for wealth is proverbially alive to its own interests; the charge of sympathy would not lie here.

There are no portions of the city where crime and iniquity are so rampant as in the poorer tenement house districts of the East side, and no portions are so poorly lighted. It will be well for the city authorities to heed the suggestion of the Tenement House Commission and lessen their responsibility in the premises. Let them introduce at once the electric light into these shades of vice, for, as the *Graphic* aptly puts it, "As a means of preserving the peace and insuring the safety of our citizens, it is second only to the policemen themselves!"

Prof. Tyndall on the Sources of Electricity.

In his lecture on the 1st ult. in London, Prof. Tyndall reminded his audience that in the preceding lecture he mentioned incidentally the action of atmospheric electricity, and he now, by the kindness of Sir James Paget, was enabled to show some garments which had been worn by a man who, during a thunderstorm, took refuge under a tree. This was a very dangerous proceeding. The tree was struck by lightning, as was also the man, on whose clothing it had an extraordinary effect. His clothes must, however, have been very wet when he was struck, for had they been dry he would certainly have been killed. It was the clothing and not the man's body which had conducted the electricity. Displaying a boot, the sole of which was a mass of hobnails, and which had evidently belonged to a "son of the soil," he said that they must remember that the destructive effects of electricity where produced entirely where this wonderful power encountered resistance. So with this boot, they saw a part of it where the leather had been all torn; but in the sole the conductivity was good, and where the foot was on the ground the electricity passed harmlessly to the earth. Resuming his lecture proper, Professor Tyndall called attention to what he described as a beautiful machine, which they owed to Mr. Wimshurst, of the Board of Trade. It would, he said, take him some time to go through the philosophy of the machine, nor was he sure that he could do so. There was considerable difference of opinion about it. In 1777 a man named Bennett invented what he called the Doubler to augment the strength of an extremely small amount of electricity. After him came a most ingenious electrician, Cavallo, and after him Nicholson, who pub lished a very famous journal, and who invented another way of starting from an extremely small amount of electricity, so as to enhance its value and to make it a very large amount. That was briefly and vaguely explained by the principle of Wimshurst's machine, which they then saw before him, and which was so constructed as to show them a number of pleasant experiments. In the early days of electricity there was talk of crackling fire and produced by the friction of amber and sticks of sealing wax, and the machine would enable them to hear and see the crackling and the sparks. An interesting experiment was then given to show this. They had now (he continued) to dwell a moment on that subject of supreme importance which closed their last lecture—the Leyden jar, which was first described by a canon named Kleist. It was discovered a little time afterwards by Cunæus, of Leyden, and with great justice called after him the Leyden jar. Exhibiting a Leyden jar, and placing it on a cake or bed of resin, the lecturer said he would pour as much electricity as he could (experiment) into the interior of the jar, which was coated with tinfoil. The positive electricity acted through the glass on the outer coating. It attracted the negative electricity of the outer coating and repelled the positive; but, the jar being insulated, the positive and negative existed side by side in the thin outer coating. When he connected they inner and the outer coating, they would get no discharge. [Experiment.] First of all, he cut the outer coating from all connection with the earth, then by means of a piece of wire in his hand he established a connection and the union of the electricities, when he put the coatings into contact and produced powerful sparks. A ball was next placed by his assistant in front of the lamp, and some bran was put under the ball. The image of the ball was then cast upon the screen, when the bran was seen leaping up to the ball, the lecturer explaining that instead of allowing the electricity which he had poured into the jar to escape through the wire to the earth, he had let it go to the ball in front of the lamp. The question might have occurred to some clever boy present—Why do you waste the electricity of the outer coating by allowing it to flow to the earth? Why not send it into a second jar? Producing a second jar, he gave an experiment to illustrate this. He then poured electricity into the first jar, which was communicated to the second jar, and by means of the wire he communicated the electricity to the ball in front of the lamp, when, with the aid of the screen, the bran was seen to jump up as before towards the ball. He next placed a knob at the end of the arm of the prime conductor at some distance from the jar nearest to it, explaining that the knob was charged with electricity. The electricity was thus, without any contact, passed to the first jar, then to the second jar, and communicated through the wire to the ball in front of the lamp, and the bran beneath was again seen to be excited as before. The action in this experiment was not, he explained, due to direct electricity, but to the inductive action of the electricity. The experiment was carried out on the previous day at a greater distance from contact, but they had been enabled to do that owing to the fact that the air was not so moist as it was at that present moment. The Leyden jar was capable of all kinds of modifications; and he thought that no exercises could be better for a boy than making some of these modifications. He displayed a kind of jar which, he said, he devised some time ago. He had a piece of vulcanized India rubber. Clasping Mr. Cotterell's hand, he stated that his own hand was the interior coating of the Leyden jar, Mr. Cotterell's hand being the outer coating. [Experiment.] They had there a large battery charged with electricity equivalent to fifteen Leyden jars. All the interior coatings were united together, and all the outside were connected with the earth. Producing a thin piece of silver wire, a weight was placed at each side of it. He then spanned from the knob of the prime conductor to the weight resting on one side of the wire, and sent the discharge through. The wire was reduced to a black powder. The prime conductor, he explained, was connected with the electric battery through the wire. They had heard him carefully warn Mr. Cotterell to keep clear of the arm of the machine, and he would tell them the reason for that. When he (the lecturer) was standing in that place some years ago addressing a similar audience, with a battery charged with equal force, his shoulder was struck by the arm of the machine. The result was absolutely nothing injurious to himself, but the wonder to him was that he had not fallen. He did not believe one member of the audience knew what had occurred, though they saw that something had happened. After standing a moment or two he seemed to open his eyes, though he supposed they had been open the whole of the time, and he saw a confused mass of apparatus before him. The optic nerve was so affected that he appeared to see himself in pieces, and it was some time before the retina assumed its normal condition. He would now pass from the region of frictional electricity into another region. He exhibited a large conductor, which was placed on two stands, and brought it into contact with the prime conductor. He explained that he brought this conductor for a special reason—because it was exactly the size of the conductor devised by Lord Mahon, to whose celebrated experiments on the return shock he referred. Near the large conductor, but not in contact with it, was a second one, from which a wire passed to the lecturer's hand. When the machine before them was worked the conductor was charged with positive electricity, and it would act on the adjacent conductor, driving the positive electricity through his body into the earth. Mr. Cotterell would take a spark from the knob at the end of the conductor. At each spark Mr. Cotterell took from the machine he (the lecturer) received a shock. There was a return of electricity into his body, and that was what Lord Mahon termed the return shock In 1786 the celebrated Galvani was making experiments with a frog. It was well known before that electricity affected the limbs of dead frogs. That was not wonderful; but what was wonderful was this. Galvani was working in his laboratory with the limbs of these dead frogs. The limbs were at some distance from the conductor, and it was observed that every time a spark was taken from the conductor a quiver occurred in them. At that time the return shock had not been explained. They were now going to an entirely different region of electricity from that which occurred in Galvani's laboratory. Galvani took a frog, hung it to a railing outside his laboratory, and watched it throughout the day. In attaching the limb of his frog he had it placed on with a copper wire, and the rail was of iron, and when the frog's limbs came into contact with the iron Galvani noticed a quivering of the limbs. Exhibiting a plate of zinc, he said that the frog they saw was suspended by a piece of copper wire. This was the second discovery of Galvani which led to the great discovery of voltaic electricity. Volta, a great man, heard of Galvani's experiment, and first of all he disbelieved it, but he worked at the subject, and became convinced that Galvani was right! The lecturer now produced a pile, which he said was similar to the first made, and was the germ from which the electric light had grown. They had before them the voltaic pile, and they could see that the manner in which it was put together justified the term "pile." In the year 1800, in which Volta discovered or described the pile, Nicholson and Carlisle observed, by accident, that when the two ends of a wire from a voltaic pile were immersed in water bubbles were caused, and that one part consisted of oxygen and the other of hydrogen. [Experiment.] The wire was immersed in a small cell containing acidulated water, and the lecturer sent a current of electricity to either of these wires, and they saw on the screen that bubbles rose from the water. One voltaic cell was insufficient to overcome the attractive force, but the two should overcome the attraction. He had spoken of the atoms of oxygen and the atoms of hydrogen. They united so as form a molecule. He had there a solution of a compound of lead—acetate of lead; and by sending a current through this solution they would decompose the solution, and on one of the wires would be the deposited lead. The minute particles of lead had the power of crystallizing, and he showed by an experiment, with the aid of the screen, that they did not scatter themselves in a confused manner, but presented themselves in beautiful fern-like forms. Subsequently he gave illustrations of electro-plating, some copper plates being made to present the appearance of silver after the experiments. He next called attention to a great discovery by Sir Humphry Davy with soda and potash, who produced a metal potassium. The affinity for potassium from oxygen was shown.

Central Station Lighting.

The following is an abstract of a paper read by Dr. Fleming, based upon his experience in America. The information contained in this paper is on points not of very general knowledge respecting central station lighting, its difficulties, and its successes, with respect more especially to the incandescent lighting in New York. The facilities of Dr. Fleming were exceptionally good, and the results given in this paper are not merely those of a hasty visit, but of weeks of careful scrutiny, and hence may be taken as absolutely accurate. Things that chiefly interest us in the history of all great experiments are the difficulties that have arisen and the methods by which they have been overcome. It has been well said that if Faraday's "Experimental Researches in Electricity" is a valuable book, yet Faraday's experimental failures in electricity would be almost as valuable, and accordingly Dr. Fleming mentioned first some of the difficulties in the problem of distributing large currents for illuminating purposes. He then said:

When Mr. Edison had completed his lamp and his dynamo, which he had practically done some time before the Paris Exhibition, he knew that between him and the realization of his project of central station lighting there stood the great difficulty of the underground conductors. He realized that the maintenance of an equal potential over a large conducting network buried in the earth and the necessary insulation of the same were not easy things, but involved stupendous difficulties, which no small scale experiments could overcome; and the history of his mind on this subject is most interesting as gathered from the study of his patents. He recognized that in order to give his station a chance of success he must pitch upon some locality where there was as great a density of consumption of light as possible—that is, as many lights per acre or as much vertical lighting as could be obtained; and he selected a spot in the extremity of Manhattan Island. He was intimately acquainted with the various projects, whose name is legion, for underground conductors, and he recognized most of them as branded on their foreheads with the stamp of impracticability. All such schemes as using the metallic sheath of an insulated conductor for a return were tried and abandoned; cables dragged through metal or stoneware pipes, troughs or channels, or laid in wooden casings, were examined and condemned. He finally selected to use copper rods, segment shaped, and put together with an insulating material of bitumen and oils, in an iron pipe. These were joined together in twenty-foot lengths by copper screw connections, the joints soldered. The reason he did this was because in city streets it is almost impossible to get a clear run free from other pipes in which to lay a conduit. If anyone not familiar with sewer work only looks for five minutes at a street dug up it will be seen that the entanglement of pipes crossing at various levels, and crossing out of the street under the pavement renders it impossible to use any method which cannot easily and cheaply be accommodated to the instant necessity of a change of level in laying down.

The first difficulty met with was in soldering the connections of the twenty-foot lengths. The joints had to be electrically perfect, and the getting of a good joint in two highly conducting copper bars, which run away with the heat as fast as you put it in, and the countless difficulties of insulation at the joints brought the workmen sometimes to despair. Edison himself was down on his knees in the trenches night after night until the job was got through, and thirty or thirty-five miles of underground conductors laid. Now came the question of the feeders. As you know the current has to be got into this double network at one side in certain places and got out again at the other, and the question of how and where to attach the feeders was the next obstacle. Edison at first thought that the problem could be solved mathematically, and so it can by a method due to Maxwell; but the mathematical solution only applies to a given case, whereas, in the real case the points of consumption are continually shifting, and the thing wanted is a practical solution. At last he did the thing experimentally. The probable consumption was first estimated as closely as possible, and the probable localities of lamps represented on a plan, and by experimental methods, the best localities found at which to supply the current. From the central station twenty feeders go out to these points, and at all the street crossings are circular junction boxes, into which the sixteen ends of cable from four sheets come to two copper rings + and —, and the feeders are attached to these. As soon as the station was started on September 4, 1882, difficulties began. First, it was found that the consumption of light shifts, the center of gravity of consumption varies, the chief bulk of the lights are going into one place at one time, and at another at the next hour. Hence they require to have a command over the point of supply, and to do this they have had to throw out of use six of the feeders, and use only fourteen, not always the same fourteen. What this proves is that plenty of spare feeders are required, so that if the potential is found to be low at one point it can be brought up, and if high lowered. They would have preferred, if possible, to add spare feeders. This necessitated a little too much load on the feeders, and one day all the main safety catches went,

and put the station out for four hours, but this is the only occasion in two years and a half. Next it was found that the conducting net work was too rigid, and broke or got damaged by the stresses brought upon it by traffic in the streets. Owing to the varying loads on the surface of streets, and the unequal density of the soil beneath, in some places hard and compact, and in other places where it has been recently opened, spongy, it is essential that the conducting system shall have a power of accommodating itself to small displacements without injury. Gas and water pipes do this by the method of attachment. The first methods of coupling the twenty-foot lengths were too rigid. Then, when many mishaps had occurred, Mr. Edison devised a cup-and-ball joint at the coupling box, which gives a certain play to the skeleton, and gives the necessary elasticity. He told me it was a perfect success. Next as to the insulation. The compound used is really a stiff fluid; and when the pipes containing the two copper rods are bent, the flexure in some cases brings stress to bear, which makes the rods gradually change their place in the material and come together. It is this very quality of bitumen being really a fluid that makes it undesirable to lay down cables in bitumen, unless the cables are kept in position by solid insulating bearers or bridges. The result of this was that in some cases they had dead crosses both in mains and in feeders. The methods now adopted are to wind the bare rods spirally with string, then put them together and wind string over the two, then put them in iron pipes and force in the insulating compound when fluid, and then danger from dead crosses is obviated. There is another cause of cross leakage, viz., conduction through the bituminous compound as the conductors get warm; but of this I will not speak, as I am now engaged in a series of experiments in the conducting power of oil and such like bodies at high temperature. Lastly, accidents happened from want of mechanical strength. When navvies have to take up streets they are not too choice where they drive their pickaxes, and in many cases they drove them through the iron pipes; but as occasion offers the thin iron gas pipe first used is being exchanged for thicker iron steam piping, and this result prevented Experience, therefore, has shown the need for: 1st, Elasticity in the network; 2d, spare feeders; 3d, great mechanical strength; 4th, highest perfection of insulation in both mains. The insulation of the + and − side is measured every hour, and the exact amount of leakage estimated and its locality ascertained. This is never allowed to exceed one lamp over the whole system. With regard to future improvements there is room for much. Enough has been said to show you that it has not been easy work to devise a system of underground conductors for large currents of even 100 volts pressure, and it will be more difficult still to devise a system on an equally large scale if the working pressure is higher, since the breaking stress tending to carry electricity through the dielectric varies as the square of the electromotive force.

It is only within the last year that the problem can be said to have been approximately solved, even for incandescent lighting. Experience has also brought forward the necessity for perfectly simple means of getting each street length isolated for testing without digging up streets, and for easy replacement of safety catches at each end. This is now done by the cast iron box, closed by a manhole lid, at each street crossing. Each positive main is joined on to the positive copper ring by a fusible slip, and each negative to the negative ring. Experience has shown the need for the most perfect contacts at these places, since a loose cantact that would generate little noticeable heat with a 100 ampere current creates a very different state of things with a 500 ampere current. One thing is certain—viz., that the laying of the two conductors in one tube is a difficulty, and it would be better to have them separate. Dead metallic crosses would then be impossible, as even if both mains are earthed the polarization resistance is considerable. We may pass next to some criticisms on the chief details of the generating station. What they did was to buy two houses in Pearl street (something like Thames-street), gut them, put in iron girders and struts, build chimney stacks, and put in Babcock boilers, Porter-Allen engines, and six of Edison's big dynamos, driven direct. They put the boilers downstairs, and the heavy engines and dynamos upstairs, and in this they made a mistake. The vibration is excessive, but it does not matter. On this question of injunction for a nuisance they enjoy special advantages. The elevated railway runs down the street, and nothing can be a greater nuisance than that is. I made special tests on the economy of their boilers and engines, which showed fairly good results but left plenty of room for improvement. The result of investigation into the lamp hours of the lights in this installation showed that the maximum does not reach 1,000 hours per annum. Now, between the engine cylinder and the lamp you have the following losses of energy: Friction in engine and dynamo; eddy currents in iron of armature and bolts; eddy currents in copper rods of armature; loss in mains and feeders; loss in badly fitting safety catches, lamp sockets, house wiring, switches, &c.; and the result is that of 100 parts of power indicated on the piston, 48 per cent. only gets dissipated in the filament as light and heat The other 52 per cent. is totally lost, of which more than 40 per cent. will be accounted for outside the mains, and even with the present boilers represents a loss of 1,880 tons of coal a year. Here is a gap for engineer electricians of the future to fill up. There is a more striking fact than this. The horse-power hours of energy dissipated as light and heat in all the filaments of all the 12,600 lamps in six months is 500,000. This is equal to a million million foot-pounds. The coal used in six months is 1,887 tons = 4¼ million pounds nearly. Each pound of coal contains 12,000,000 foot-pounds of energy. Hence nearly 50,000,000,000,000 (fifty million million) foot-pounds of energy are used to get one million million as light and heat, or 49-50 of the total energy of the coal is irrecoverably lost. The second law of thermo-dynamics forbids our getting back the whole of this, but there is a vast fraction which can be recovered. Can we ever hope to bridge this gulf and get the energy out of the coal direct, and, if so, where is the genius who is going to show us how? The world waits breathless for his advent.

The author thought it would be advantageous to use compound machines. Referring to meters he said: Meters deserve one word. I do not think, from what I know of the zinc voltameter meter that it is the meter of the future. We are still waiting for an accurate mechanical meter, not dependent on complicated gear, and capable of being made for £3 or £4, or less; so that a rental of 1s. a quarter may pay the interest on capital outlay on meters, and provide a little something for a meter sustentation fund for pensioning off and replacing old and decayed meters. My determination of the accurate lamp hours of the station has enabled me to determine the average hours' burning of each lamp per year, and it is about 900 hours. Now, this is very interesting and important. It shows that in a district composed of shops, warehouses, restaurants, banks, &c., when people tap and use the light as they like, the average lamp-use per annum is less than 1,000 hours. Now, I do not believe that a residential district would double this, and that therefore all those estimates for cost of electric lighting of towns based on 2,000 hours and upwards are misleading and incorrect In one estimate, which was drawn up for the town of Sheffield for 10,000 lamps, the draughtsman assumed as the basis of his calculation 30,000,000 lamp hours per annum. At the end, however, he says this is probably too much, and finally surmises that half that amount would be right. Any estimates of cost as compared with gas are in error if they assume much more than about 1,000 hours per lamp per annum.

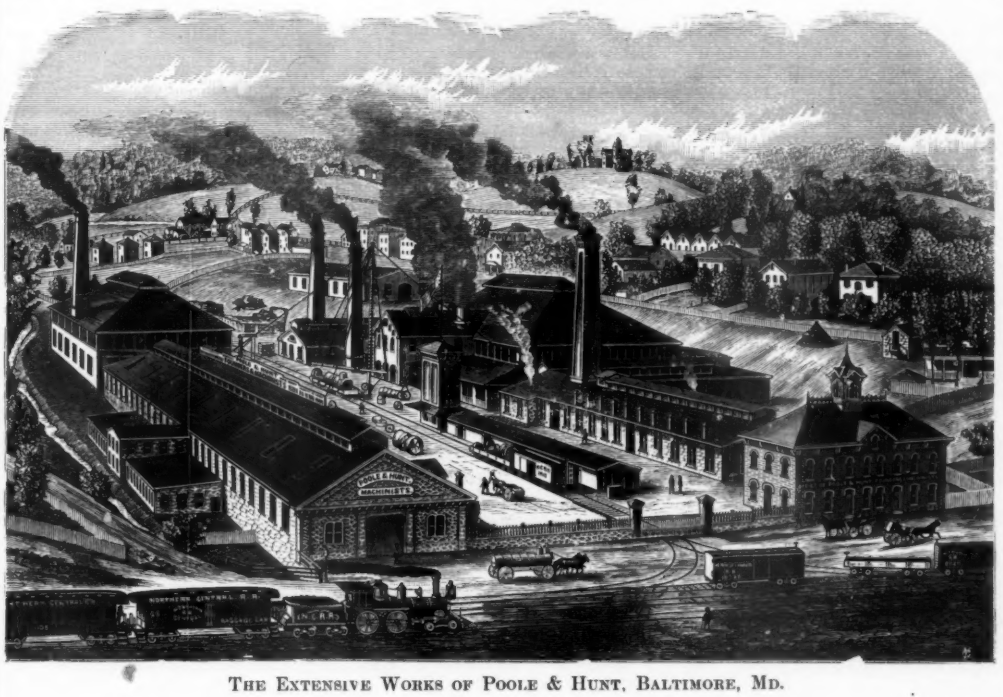
I must now say one word on the subject of multiple conductors. In July, 1882, a patent was taken out by Dr. Hopkinson, and followed by two others by Mr. Edison in December, 1882, and June, 1883, for a system of multiple conductors, in which combined parallel and series grouping is used for dynamos and lamps. You all know about it, so I need not describe it. Its advantage is that it effects a saving of copper over simple parallel in the proportion of $\frac{M}{2(M-1)^2}$ to unity, when M is the number of conductors. Practically for three conductors it only saves about 30 per cent. on the whole.

They have this system working in thirteen places in America, and in three of them the triple conductors are underground, and in one tube (Newburgh, Brockton, Fall River). I had a long and special talk with Mr. Edison on the extension of this. To my mind one of the most hopeful directions for inventors to work is given—that ground is too expensive in a district to admit of a central station, nevertheless, we can bring in from a distance to a central room current of high potential by light mains, and there split up the potential and distribute it. It can be done by multiple conductors, without secondary batteries or secondary generators. The problem of the future is not central stations, but ex-centric stations, getting electricity generated on cheap land, and bringing it in by highly insulated feeders at high potential to places of division.

Although we in England seem to drag behind, I yet believe that the interesting and fascinating problem of publicly distributed electricity will be solved some day for ourselves on English soil. We call our practical electric units after the names of great investigators. Three out of the eight are named after Englishmen; and it is impossible to doubt that the country of Watt, Faraday, and Joule has in it engineering and electrical skill to overcome the difficulties to which I have most briefly alluded; and, unless there is some radical impracticability about the whole problem to grapple successfully with it, and give us, in the dying words of Goethe, "More Light."—*Electrician.*

The Works of Poole & Hunt, Baltimore, Maryland.

It has been justly said that, as the home of great engineering skill, Baltimore has for many years enjoyed a most excellent reputation, not only in America, but also in Europe. Baltimore engineers and engineering work have always been regarded as equal to the accomplishment of the most difficult undertakings, and this reputation is well deserved. Probably in no way is the standing of Baltimore mechanical engineering work better illustrated than by a reference to the business of Messrs. Poole & Hunt. This firm has now been in existence over a third of a century, and the highest commendation that can be given them is simply to mention one or two of the large contracts that they have received when in competition with the whole country. Chicago, for instance, is a great city; and yet, two or three years ago, when the first cable street railroad was to be constructed in that city—a work involving several million dollars—Messrs. Poole & Hunt received the contract for furnishing the enormous amount of transmission machinery required; and such was the case in Kansas City; and again even in New York, the largest manufacturing center in the country, when the Third Avenue Cable Road ordered their machinery of the same firm. In addition to these roads, Messrs. Poole & Hunt are now building the same class of machinery, but on a much more extensive scale than for any other road in existence, for the new cable road in Hoboken, N. J. In this connection it may be said that all cable roads whose plants have been furnished by Poole & Hunt are now in successful operation. Their works now cover eight acres of ground, and are in every way admirably located for the manufacture, handling, and shipping of machinery to all parts of the country. The iron foundry, pattern shop, melting house, brass foundry, blacksmith and machine shops, pattern loft, tool room, and in fact every department connected with this extensive establishment, are all systematically arranged, and replete with every modern appliance for doing the best work with the greatest dispatch. This firm manufacture steam engines and boilers. Besides the engines manufactured by this firm suitable for driving dynamos, they make a specialty of the Leffel double turbine water wheel, which is well known, and has no superior in the market. It is used wherever water power can be utilized in place of steam power for electric lighting.



THE EXTENSIVE WORKS OF POOLE & HUNT, BALTIMORE, MD.

A complete account of the organization of the National Electric Light Association will be found on 4th and 5th pages.

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On Wednesday last Benj. Butterworth, Commissioner of Patents, handed his resignation to Secretary Teller, who accepted it and complimented him upon his energetic administration of the office.

The electrical exposition, organized by the International Society of Electricians at the Observatory at Paris, will open March 15. It will be the first of a series of special expositions, preparatory to the great universal and international festival in 1889.

On Tuesday last Commissioner Butterworth, of the Patent Office, rendered his decision in the telephone interference case of Bell against Gray against McDonough, against Voelker, and others. The Commissioner affirms the findings of the Board of Examiners, and awards priority of invention to Alexander Graham Bell in all claims of importance.

CONCERNING TELEPHONE CHARGES.

The following circular was issued in Boston recently, addressed to the subscribers to the New England Telephone Company:

To Telephone Subscribers:

The New England Telephone Company, forced by the demands of the American Bell Telephone Company, is advancing rates for various kinds of telephone service.

We believe that this monopoly should be forced by law to reduce and lower its rates for all classes of telephone subscribers. Believing thus, we desire the co-operation of all the subscribers in the State, to aid in the movement started in the petition of E. H. Morse, that "telephone charges may be reduced and limited by law."

This petition is now being considered by the Committee on Mercantile Affairs at the State House. We have the opinion of the best lawyers in the State that such legislation is constitutional, and we ask you to sign enclosed petition and mail it to us, if you think it a wise one, and get any other signatures convenient.

As this is a matter of legislation, and as we shall be forced at the State House to fight this rich monopoly with all its influence, it is desirable that every subscriber in the State should call the attention of the representative and senator from his district to the interest of the people. Please give us any information you may possess of the feeling of these gentlemen as to the merits of our proposition.

When the contest is over, we shall take means to inform every subscriber who of the members of the Legislature stood by the people, and who stood by the monopoly.

Five minutes' action now may save us each twenty-five dollars a year henceforth.

TELEPHONE SUBSCRIBERS' UNION,
Box 2734. Boston, Mass.

The result was the receipt of a number of names, for there soon appeared in the Boston papers a petition to the legislature with the names of some prominent business houses and individuals appended thereto, asking for the regulation of telephone rates.

Whether the legislature has or has not the legal right to fix or regulate telephone changes is a question much discussed. True the telephone company is a creature of law, but the law gives it no *exclusive* privileges. If the law said that the New England Telephone Company, *and no other*, should be entitled to do a telephone business in Massachusetts, there might be ground for supposing that the legislature had a right to fix prices. But, the fact is that the telephone company is a creature of law in the same sense that a cotton manufacturing company is a creature of law, or an express company, and we have not learned that the law steps in to regulate either the price of cotton goods or the rates charged by express companies.

The telephone companies are just now between the upper and nether millstones of the law. On the one side legislation is sought compelling them to put their wires underground, an expedient not only expensive, but, for long distances, of doubtful success, while on the other, its aid is sought to "regulate,"—a polite way of saying "reduce"—telephone charges.

Concerning the equity of present rates we have more than once expressed an opinion. On the average, as a matter of fact, they are not remunerative. We do not hesitate to say that, outside of four or five principal exchanges, the business of the New England Telephone Company yields no profit, and we are confident that any fair-minded man, investigating the subject thoroughly, will admit that the prices charged subscribers in nine tenths of the territory of the New England Company are absurdly low considering the service rendered.

There is one way in which all this trouble can be avoided. It is not within the power of man to fix a yearly rate which is equitable for all subscribers, because no two subscribers' needs are exactly alike. But it is possible to establish the toll system, and make every man pay for what he has, no more and no less. That is equity, and no legislature would ever interfere with it.

NOTES AT THE CONVENTION.

The report printed in another column gives a comprehensive idea of the work accomplished by the Convention of Electric Light Companies held in Chicago last week, of the subjects considered, and of those who were present and took part, but there are many points which do not properly belong in such a report, many thoughts, suggestions, and impressions which came to my mind during the sittings and since, which it may be well to put on paper in order that those who had not the good fortune to be present may get a complete idea of its results.

It was happily said by one of the delegates that it was an experience meeting rather than a convention, a sort of a love feast, where each told his story and listened to those of all the others. When it met it was merely an assemblage of men, having, it is true, a common object, but unknown to one another, and without organization of any kind, and with only a general community of purpose. When it dissolved it was an organized association of individuals, firms and companies, bannded together for a well-defined purpose, acquainted with one another personally, and with a large amount of work laid out for future investigation, consideration and report. This, in brief, is what this first gathering has accomplished. It has set the ball rolling. It has organized a National Association on a broad and comprehensive basis, and it has started many inquiries whose solution cannot but be beneficial and profitable to the whole electric light interest of the country.

It was foreseen at the outset that any introduction of questions affecting the relative merits of different systems would bring in an element of discord, and it was suggested at the outset that no such question should be broached. This became at once, without vote or formal action of any kind, the unwritten law of the convention, and was most loyally observed and obeyed. It had been suggested in these columns that there was quite enough for such a convention to talk about without going into the matter of systems at all, and the event fully proved the truth of these suggestions. For lack of time, and especially for lack of preparation—inevitable in the case of a first meeting—the questions brought up were not half discussed. Indeed, but little more was done than to open them up, and to show still more clearly the need of such discussion.

Those who thought, as some apparently did, before the Convention was held, that it was organized in the interest of any particular company or system, must, if they have taken the pains to inquire, have had their illusions pretty thoroughly dispelled by this time. There was at one time—say two or three weeks ago—a good deal of talk of that kind. It did not seem desirable to mention it, or to take any notice of it. There was but one way to stamp it out, and that was to let the Convention prove it false by its action. This the Convention did, and I think that the number of those who do not believe that the assemblage made a *bona fide* effort to set machinery in motion which would advance the interests of electric lighting in all its forms and phases, is reduced to a small and unimportant minority.

The Convention was particularly fortunate in its selection of a President. Mr. Morrison, of Baltimore, is one who presides with vigor and good nature, keeping everybody up to the mark, but doing so in a way that displeases no one. It was owing to his happy faculty of "pushing things" that the Convention covered the amount of ground that it did during the short time its delegates remained together.

When it came to blocking out the organization of a National Association, one difficulty immediately presented itself. It was clear that the Association should be formed, substantially, of companies, firms or individuals engaged either in the manufacture and sale of electric lighting apparatus, or in the use of electric lighting plants. But it was also obvious that there was a large number of persons, firms and companies engaged in allied industries, whose experience and knowledge are of the utmost value to electric light men. It is true that they have a private interest to serve, but it is also true that they have invaluable opportunities for obtaining important information which is of the utmost value. Such men it was not thought best wholly to exclude, nor was it thought proper to admit them on the same plane with those directly connected with electric lighting. Hence a grade of associate membership was adopted, and to this such persons may be admitted by a vote of the Executive Committee. It was thought wise to put in this limitation, because each case must be judged on its merits, and the Executive Committee, as the governing body of the Association, seemed to be the proper tribunal for decision.

At the Convention things had to be done with a rush and drive, for the members were anxious to get home. Now comes the time for careful and deliberate work. A circular, setting forth all the facts in the case, giving an outline of the Convention's work, and of the organization of the National Association, together with a copy of its constitution, will be prepared at once by the Secretary, and by him submitted in proof to the members of the Executive Committee for their approval. When that is obtained a copy of the circular will be sent to every electric light company in the United States, inviting all to become members. By correspondence, and possibly at least one meeting, the Executive Committee will arrange for a summer meeting of the Association, with a well-considered and carefully digested programme, at which papers previously prepared will be read and discussed. The work needs to be done carefully and prudently, and without "drive."

In closing, it deserves to be said that never was there a convention which devoted itself more assiduously and steadily to business There were three sessions the first day, and two the second, and at each and all the attention was close and the interest unabated.

The Electric Light Convention.

REPORT OF THE PROCEEDINGS.

Representatives of the various electric light companies and interests, to the number of upwards of 100, met in the city of Chicago, at the Grand Pacific hotel, Feb. 25th. The convention was called to order at 11 A. M., by Mr. Wm. A. Hovey, of the ELECTRICAL REVIEW, who stated that the call had been issued on the request of a large number of those engaged in the electric light business, and that the objects were to perfect a permanent organization, arrange for annual meetings and the discussion of such questions as would be of interest and benefit to all members of such a convention. George S. Bowen, of the Van Depoele Company, of Chicago, was elected temporary chairman, and H. D. Stanley, of the Bridgeport Electric Light Company, Secretary *pro tem.* Mr. Bowen, on taking the chair, alluded to the embarrassments and depression that had been felt in the electric light business during the past year. The appliance of the light was but yet in its infancy, and many difficulties had surrounded it. During the last twelve months those in the business had been subjected to peculiar trials, but he had every reason to apprehend a brighter and more prosperous future, which he hoped would be inaugurated this year, and he was confident that some substantially valuable results would grow out of this convention, including as it did so many well-known representatives of both the manufacturing and operating divisions of the business from all parts of the country.

A committee on credentials and permanent organization was appointed, consisting of the following gentlemen: C. A. Brown, Chicago; C. J. Richards, Racine; G. H. Wads-

worth, Cleveland; Frank Ridlon, Boston; and S. Baldwin, Baltimore. Also a committee on programme and progress of business, consisting of Messrs. Powers, Bullock, Place, McDonald, Randolph, Crossman, Reid, Scribner, Buckley, Hovey and Bowen.

At 2 P. M. the convention was welcomed to the city of Chicago by Mayor Carter Harrison. He hoped that their deliberations would be careful and wise, and out of their deliberations there might be more light. They had to deal with the most subtle of fluids. It was the greatest agency handled by man. No man knew its power, but that should not discourage them. Electricity was the breath of the Deity. It was all powerful, yet harmless when not too contracted. It was for them to work it so that it might be harmless. He touched upon the recent telephonic achievement of talking from Chicago to New York; alluded to the increased facilities of the sub-marine cable service, and ended by speaking of electricity as "a giant force, powerful enough to rend the ancient oak and melt down the granite of ages, yet in the incandescent light it was made as soft as the down upon a woman's cheek, while in her glossy tresses it aroused a spark, even if it did not generate one."

Prof. Elisha Gray was then called for and spoke of electricity as the greatest wonder of the century, of its need of development, and predicted that we were but standing on the threshold of its wonders.

The committee on organization reported the following for officers of the convention: President, J. F. Morrison, of Baltimore; Vice Presidents, H. M. Cleveland, Hartford, and J. H. Yarborough, of Nashville; Secretary, W. A. Hovey, ELECTRICAL REVIEW. Charles A. Brown, of the Western Electric Light Company, presented a gavel to the new President, remarking: "It represents a commutator on an electrical light, and I trust that the convention in its deliberations will have as cohesive a number of segments."

Mr. Morrison thanked the convention for the honor, and in a brief, practical address opened the convention for the business that had brought many of the members hundreds of miles.

The committee on digest of papers and programme of business reported the following order of proceedings and topics for discussion:

1. Incandescent light, particularly in regard to length of circuit upon which they can be run with profit.
2. Locating and avoiding crosses with telephone wires.
3. Power and its conversion into light.
4. Electric light globes and shades.
5. The best modes of connecting dynamos with power.
6. Electric lighting by water power.
7. Rates and rebates on electric lights by the year.
8. The use of electricity as applied to motors.
9. Where an electric-light system requires No. 6 conductor, is it desirable to use Nos. 6 and 4 in the same line?
10. Will armatures become affected by frost when exposed in transportation?
11. Special insulation or guards to insulation of lines at dangerous points and places.
12. Street lighting—the best manner and modes of accomplishment, embracing the location of lights and running of circuits.
13. Experience and results in the use of underground conductors.
14. *Resolved*, That the fireman should receive more pay than the engineer.
15. Help generally.
16. Experience of electric-light companies in the use of copper-coated and uncoated carbons.

A letter from Mr. A. S. Hibbard, superintendent of the Wisconsin Telephone Company, addressed to Mr. C. A. Brown, Chicago, relative to the respective rights of telephone and electric light companies was read by the president and submitted to the consideration of the meeting. The writer felt that the telephone interest should be considered by the electric light convention, if only for the purpose of discussing the mutual rights and equities in overhead wires. The telephone men's complaint against the electric light companies is that in a number of instances the rights of the telephone companies are disregarded entirely. They allege that the light men have built lines along the same side of the streets with the telephone wires, either above them or underneath them. It was well known that there is a heavy induction from electric light wires on to telephone wires, and as a result there were loud and disturbing humming noises on all telephones in all localities where the electric light wires were. Enough had been shown in the experience of telephone companies with the electric light to prove that there is danger in too great proximity. While they had no desire to place impediments in the way of the electric light companies, and wished to be friendly neighbors, they thought it would be best that they should be next-door neighbors, and not attempt to occupy the same house.

Professor Gray said induction troubles might be avoided, but this involved expense. Wires could be laid in the ground and so protected as to prevent induction, but there must be some conducting substance between the two wires. Lead pipes had worked well. Another way was by the metallic circuit. This would cost the telephone company two wires instead of one. There would be no danger from grounds, as the electric light company has the metallic circuit. There was no way to prevent crosses with overhead wires. The wires should go uppermost which was the more liable to stand. Where they cross at right angles there is no induction only where they run parallel. President Morrison said the question of induction was a bug-bear. Professor Gray had skillfully gone around the question and touched the telephone side of the question, avoiding the electric light companies' position. When the electric light was a success the telephone companies commenced the outcry against the electric light companies and desired the latter to go on other streets and keep out of the way of telephone wires. The electric light was not a luxury but a necessity, as much so as the telephone, and the light should be allowed to run on the streets if law and order was to be preserved and the police kept tolerably safe. A properly constructed electric light was not dangerous any more than a buzz-saw in a saw-mill. Telephone wires could be run alongside of electric light wires if insulation did not rub off. Every city, except Chicago, had given the right of way to electric light companies.

Mr. Hovey said that 78 per cent. of the fires in New York by wires were from those underground; there were twenty times as many wires overhead as underground. Prof. Gray said the telephone and electric light interests were mutual. What was wanted was to arrange the circuit of the two systems to the best interests of both. He recommended the establishment of telephone and electric light stations for observations to trace out phenomena, and facts thus secured were better than theories. A recess was taken until 7.30 o'clock.

After the evening session had been called to order the subject of "Electric Lighting by Water Power" was discussed. George Fletcher, of Dixon, Ill., created considerable amusement by a description of his plant for furnishing electric lights. He said he employed water power, and was asked who his engineer was. He said the Lord furnished him an engineer in the shape of a turbine water wheel which was seventeen years old and cost $1,250. His carbons cost him $15 a thousand and he ran thirty lights. The wheel ran a saw-mill and electric lights as well. The cheapness of this plant and Mr. Fletcher's manner of stating the facts convulsed the convention with laughter. "The best mode of connecting dynamos with power" was then brought up. Mr. Ide, of Springfield, then gave a description of the plant of his company, and was followed by Mr. Steward, of Chicago, who said the best means was belting direct from the machine to the dynamo. Mr. Weeks, of Kansas City, was of the same opinion. Mr. Sperry, of Chicago, avoided a perpendicular belt. There was a disadvantage in using a too heavy or too thick a belt. President Morrison said the New York Company at the start used the single pulley on the dynamo. This was abandoned, and a Corliss engine, with a gear-wheel, put on. In Philadelphia they had sixteen engines at the start, with sixteen dynamos, belted direct from the engine to the dynamo. This was too expensive, and two engines were introduced of twenty-five horse-power, driving the main shaft and belting down to the machines. In Baltimore their shafting ran the length of the engine-room, with two rows of dynamos. The engines were belted to the line of shafting. A Corliss engine was first used, and then Buckeye engines of different power. The Frisbey clutch-pulley was used, but the plant was a failure, by reason of hot bearings. The clutch-pulley was discarded, and a line of shafting put on top of the joists. The shafting of the dynamos was changed and tight and loose pulleys used, and since this was done no trouble had been experienced. It was his opinion that friction clutches were useless.

Mr. Weeks, of Kansas City, inquired about the rocking-grate bar, but no one had used it. It was stated that washed screenings had been used advantageously. Inquiries were made concerning smoke-consumers, but it appeared the electric light companies did not use them. A skillful fireman was said to be better than the style of furnace in use. The use of blowers was favored by some and opposed by others. A variety of views were expressed concerning the utility of the Jarvis furnaces, which were highly commended by those using them. "Rates and rebates on electric lights by the year" was considered. Mr. R. J. Randolph, of Rockford, said in winter they ran fifteen hours and a half in stores and dwellings. He ran three circuits, shutting down the lights at 7, 8, and 9 o'clock, and charging accordingly. "The use of electricity as applied to motors" was discussed by Mr. Hovey. He thought the system had not gone beyond experimental points. To carry the current in high tension form where it can be utilized was well worthy of consideration. The matter of motors had not gone beyond the experimental state. Scientific experts were not practical men, but they could overcome electrical disturbances by applying their theories to practice. Motors must be taken out of the laboratory. Some one must do it, and some one must loose money. Mr. Van Depoele said electricity could be used for transmitting power. That much had been demonstrated. The power of a motor could be governed in the same way that an engine is. The speed would always be the same whether the load was increased or decreased. Mr. Sperry said motors could be run, and that much had been settled beyond a doubt. They would be used the coming summer in driving fans Mr. Curtis said that Cleveland was using street cars with motor appliances. Mr. Hockhausen, of New York, said in Europe motors were a great success. In New York they were used to drive fans to cool offices, and work elevators. They were put there to show the system more than to make money out of them. The only practical railway in this country where the motor worked successfully was the one in Cleveland. Field's motor he knew nothing about, especially as to its power. There was talk of putting a Daft motor on the Brooklyn Bridge. Mr. Wadsworth saw one in Boston in full operation. President Morrison thought the power of a company ought not to be diverted to motor purposes as it might be required by their customers. Several held to the contrary, relying on the fact that all of the power purchased was not always in use. A resolution offered by Mr. Hovey for the appointment of a committee of five to consider and report upon the organization of a National Electric Light Association was adopted. The Chair appointed as such committee, Messrs. Hovey, Brown, Bowen, Bullock, and Sperry. The next topic was, "Where an electric light system requires No. 6 conductors is it desirable to use Nos. 6 and 4 in the same line." The question was decided in the affirmative. The convention adjourned at 11 P.M. to 10 A.M. Thursday.

THURSDAY'S SESSION.

The convention assembled at 10:20 A.M., and the regular programme of addresses and brief discussions upon electrical subjects was then taken up, commencing with the consideration of "Special Insulation of Wires in Dangerous Places," the topic being opened by Mr. C. C. Haskins, the electric light inspector for Chicago. He described the proper standard of spaces to be observed between lines to obviate danger from friction and fire. In his judgment it was often safer to lay wires passing over woodwork close together, rather than far apart. The escape of electric current from one wire to another when at some distance apart, if continued long, resulted in scorching and charring the woodwork, and then there was always some very excellent kindling wood when a spark did come. On the contrary, when the wires were reasonably close together the current could pass from one to the other without charring the wood. Mr. Robinson, of Providence, spoke of his experience with wires gathering moisture in damp rooms, and Mr. Bell of Minneapolis, and Mr. Place of Chicago, spoke on the same topic.

The question whether frost would damage dynamos in transportation was answered in the negative by Mr. Van Depoele. Mr. Sperry agreed, but said the moisture from the thawing of the deposit of frost, if heavy, would be liable to be damaging.

"Incandescent Lighting and Length of Circuit" was considered, Mr. Sperry relating his experience in that line. Such lights, so far as the distance they could be worked, depended upon the resistance. Sir William Thomsons' formula was the best one to be governed by. Mr. Wadsworth spoke of these lights in New York, where they were operated four miles and a half from the station. He did not know as to the economy of it. Mr. Ridlon said the same had been done in Boston. As to economy, he thought the gas companies might furnish the power. Mr. Van Depoele said automatic arrangements would have to be used. The best mode of propagating the light was the multiple arc system. Mr. Cleveland, of Hartford, said the length of the current required a central station, with sub-stations one mile apart. This plan had been tried successfully by the Schuyler Electric Light Company of Hartford, Conn. Mr. Place favored this plan, and discussed the topic at some length.

"Street Lighting" was brought up, and Mr. Bowen said there were many different systems—towers and also lamps hanging at the intersections of the streets. Nashville employed the latter system, and the lamp was perfectly fixed. As regards the economy, more light was obtained from a group of lights placed on a tower. Where cities were compactly built, the alleys were lighted by this system. Six lights on a tower did as much lighting as eighteen on poles. The City of Detroit had ninety towers and 350 lights, and it was handsomely lighted. Elgin was so lighted, and New Orleans, and the result was gratifying. It was the most economical way of lighting a city. The towers should not be too high. Mr. Weeks, of Kansas City, had found that the tower system gave dissatisfaction, especially where the streets run at angles. In Detroit there was dissatisfaction, and they favored the pole system. Quincy adopted the latter plan, and the light was cheaper than gas. The best method was by poles at the intersection of streets. Mr. Fletcher, of Dayton, agreed with Mr. Weeks. Committees had visited the different cities, and found the pole system more satisfactory than the tower. In Dayton the duplex lamp was used, and water furnished the power. Mr. Randolph, of Rockford, said they had run lamps on wires stretched across the streets, and two lamps had fallen. He advocated the tower system, especially for small towns. It could not be done in Chicago, especially in the business portion of the city. Elgin, he said, was one of the best lighted cities in the United States,

(*Continued on Eighth Page.*)

Telephonic News

*** The number of telephone exchange subscribers in the New England Company was 15,549, Feb. 1. The instruments in use Feb. 1, 1884, were 17,459. The number Dec. 1, 1884, when the last report was made, was 17,715.

*** At the annual meeting of the stockholders of the Bell Telephone Company of Philadelphia the present directors were elected to serve during the ensuing year. Henry Bentley was re-elected president, Samuel M. Plush, general manager, A. A. Ziegler, treasurer, and George W. Snyder, superintendent.

*** The new switchboard magneto receiver reported from Boston will fill a decided and long-felt want in all large exchanges. It is light and not uncomfortable to wear, and, what is very essential, is said to be heard as clearly and distinctly as the ordinary Bell receiver. City operators, where the rush of calls makes the use of both hands necessary, will rise up and with one warm, welcoming "Hello" call the inventor blessed.

*** The directors of the Erie Telegraph and Telephone Company at Lowell, have accepted the resignation of W. A. Ingham, as president, and the directors elected James W. Bennett, president. The vacancy in the board of directors is not yet filled. This action of the Company takes out of its service the only officer in it who understood its affairs thoroughly, and who was competent to manage it on a practical basis.

*** How many less unemployed men there are in this country than on the first of January is purely a matter of speculation. But it is a pleasure to be able to say that the number is very materially less. Every week iron works and manufactories that have been idle are starting up, giving employment to men that have been living in enforced idleness. Business of all kinds is slowly but surely improving. Nothing is to be more desired than that every man desirous of working shall find remunerative employment.

*** An Evansville, Ind., paper publishes the following: "The first trial by telephone that we have ever heard of occurred last week. One Thomas Russell, of Folsomville, had been complained against before Squire Shepherd, of this place, for violating the criminal law of Indiana. Squire Shepherd issued a warrant for his arrest, and placed it in the hands of his constable. The constable made the arrest at Folsomville, a distance of ten miles. The justice of the peace was called, and answered at the telephone box in Handy, Armstrong & Cockrum's law office. He was informed that Mr. Russell wanted to plead guilty to the charge. He received the plea, fined the prisoner five dollars and the cost, which was paid to the constable and the prisoner discharged.

*** It appears, as stated last week in the REVIEW, that Thomas A. Edison, Siegmund Bergman, and Charles Batchelor are the incorporators of the Railway Telegraph and Telephone Company, whose certificate of incorporation was filed in the County Clerk's office in New York City on February 18. The company is to purchase and use, or license others to use, patents, mechanical contrivances, etc., relating to the application of electricity to telegraphy and telephony generally, and more particularly to telegraphing and telephoning between railway trains in motion and stations and moving trains. Its capital stock is $1,000,000, divided into shares of $100. The incorporators, with Ezra T. Gilliland, John C. Tomlinson, Samuel Insull, and William Wiley Smith, are to be its trustees for the first year.

SALEM, MASS., Feb. 28, 1885.

Editor Electrical Review.

I read in your paper of the 21st, that all the employes in the clerical and construction forces of the telephone company in Minneapolis and St. Paul, had had their wages reduced. Here is, I think, a subject worthy of comment. It is a well known rule, that when companies wish to practice economy, reduction of wages is the first step taken. If equality were practiced there could be little said, and no criticism offered. I do not understand that the superintendent, manager and other officers suffer a like reduction.

Supposing an inspector gets $65 a month, and a superintendent $200, is it unfair to expect a like distribution of favors? An inspector or line man is employed at a stated sum, supposing him to be competent and faithful. If the company fails to secure as large an income as is expected, he is in no wise blamable for it. A superintendent or manager is employed for the same reasons, and if a company is unsuccessful, to him perhaps a portion of the blame is attributable. Now, why in the interest of stockholders, should not he suffer in common with others. Companies suppose they pay the market value of each of their employes, and all should suffer in common the result of depression.

One reason I apprehend occasions this (and I see no reason for believing otherwise in this case) is, that when once a class of operatives have their pay diminished, it is rarely put back to the old figure.

G. H. S.

The Thermo-Microphone.

Some interesting experiments with this transmitter were recently made in Paris at the hall of the French Geographical Society, and a large audience were enabled to hear a singer, and various instruments performing in a room, a considerable distance away. This experiment was a very remarkable one, although at the end of the trial, the loudness and clearness of the tones diminished considerably, possibly on account of defective regulation. In its normal condition the definition of sound transmitted by the thermo-microphone is very excellent, even to an audience 35 ft. or 40 ft. away.

What Superintendent Wallick Says of the Cost of Maintenance of the Telephone Service in Indianapolis, Ind.—Something About the Company and its Operations.

"Few of the people who are constantly complaining of the rent charged for telephones have an adequate idea of what it costs to maintain the service," said J. F. Wallick, superintendent of the Western Union and a director of the telephone company in Indianapolis. "They seem to think that our net profits amount to about the same as our gross income, and that after the plant is once established, the expense of operating it is trivial. The people generally do not understand how this telephone business is conducted."

"Tell me something about the company and its affairs."

"Well, it is called the Central Union Telephone Company, and it controls all the telephone exchanges in Ohio, Indiana, Illinois, and a part of Iowa, excepting in the cities of Chicago, Cincinnati, and Evansville. The Western Union Telegraph Company has no stock in it here, as is popularly supposed, and I am only a director. The profits of the company never have been great, and I don't think they ever will be. The highest dividend ever paid was 6 per cent., and last year we paid only two dividends of 1½ per cent. each. Of course, the income arising from rentals is very large, but it is not productive of any great profit, on account of the exorbitant royalty we have to pay. For every instrument we have in use we pay the Bell Telephone Company $20 a year, calculating from the time it is shipped from Boston to the time it is returned there, or satisfactory proof has been furnished of its destruction by fire or other cause. This is for the mere shell of the instrument, and the local company furnishes the battery and other apparatus. It is the Bell people who make the money and pay enormous dividends, not we."

"How extensive is your business in the city?"

"We have about 1,000 subscribers. About thirty of these are 'dead-heads'—that is, instruments furnished the city offices and others, and for which we pay the same royalty and get no return. I can give no figures as to what the total cost of the Indianapolis exchange has been, for it has passed through the hands of several companies, and there have been four entire changes of apparatus. When we moved to our present quarters we adopted a new system, with many changes from the old. It cost us nearly $40,000, and we are spending large sums of money every month in perfecting the apparatus. We have thirty-eight persons regularly in our employ, and are compelled to pay taxes on our tangible property in every township in the State, as well as our gross receipts, in accordance with the law of 1883. We claim to have positively the best telephone service in Indianapolis of any city of the United States, and we are supported in this by the testimony of Mr. Price, who has charge of the government telegraph and telephone system of England, and who, after visiting all the larger cities in this country last summer, wrote back that in his opinion the Indianapolis exchange, in equipments and service, was the best in the world. The charges here are not so large as in other cities. In Chicago it is $150 per annum, in Louisville about $100. In Cincinnati it was $84, and has lately been increased to $125."

"What about the lines to outside towns—are they profitable?"

"Not at all," said Mr. Wallick. "They scarcely pay operating expenses, with no return for the original investment made in putting them up. The trouble with telephoning a long distance is that we can't work two wires on the same poles for more than a mile or two, as they interfere with each other. We have two to Danville, Ind., but can use but one, and until some device is discovered to remedy this, the expense of keeping up communication with outside towns will remain very great.

"Some of the people who think our charges are too high argue that if we made them lower it would greatly increase the number of subscribers. Possibly this is true, but owing to the peculiar nature of telephone apparatus, if we were to get twice as many subscribers as we have now, it would increase our expenses four-fold and greatly decrease the value and efficiency of the service. We have as many now as we can conveniently attend to, but if we were compelled to cut down our charges to $3 a month, as a bill now pending in the legislature provides, we would be compelled to close up every exchange in the State. Take Indianapolis, for instance. At that rate our gross annual earnings from a thousand subscribers would be $36,000. Of this amount we would have to pay the Bell Company $20,000 royalty, which would leave us $16,000 to pay the wages of thirty-eight people for a year, keep our lines and apparatus in repair, pay rent, insurance, and taxes, and all other expenses. We could not begin to do it."

Telephonic Circuits.

At the present time comparatively little attention is paid by electrical engineers or scientists to telephonic matters, although there is much that is interesting in the subject. Although we hear from time to time rumors of warfare and threats of litigation between telephone companies, or between a company and individuals, yet the rumors do not form themselves into tangible shapes. The discussions and correspondence which are occasionally carried on with reference to the validity of certain patent claims and the correctness of certain theories, if not logically conclusive, are at least of interest as bringing us a little nearer to a precise comprehension of the action of the telephone. The main point at issue is that concerning the possibility of producing articulate speech by transmitters working on the make-and-break principle. We ourselves are very far from being convinced that make-and-break working is possible, *i. e.*, that articulate speech can be *produced* by a make-and-break action, that it can be produced *in spite* of such an action is quite probable. We have not yet seen one single experiment which has in the slightest degree proved that articulate speech can be *produced* by the action referred to. The fact that words were heard with a Reis transmitter is no proof whatever upon the point, as it is quite probable that the instrument is capable of causing a variation of resistance at the points of contact, though with no degree of certainty. Recently our verbose correspondent, Major W. C. Barney, has attempted to prove experimentally that an undulatory current through a closed circuit is not necessary for telephonic transmission, and he claims that the experiment of causing a rapid series of interruptions in the *transmitter* circuit, which did not prevent good articulation, was a proof of this statement. We must confess that we entirely fail to see the force of the argument. It is not clear, in the first place, why the interruptions should be chosen to take place in the transmitter rather than in the receiver circuit, seeing that it is Bell's and not Edison's claims that are being attacked; leaving this question aside, however, it seems to us that the correctness of his argument must stand or fall by a consideration of what is *technically* meant by a "closed" circuit. The technical meaning of "closed" and "open" circuit working in telegraphy is, we believe, well understood; by a closed circuit we certainly do not mean a circuit which is never under any conditions open at all, nor, on the other hand, does an open circuit mean one which is never closed. It would be generally admitted, we think, that a momentary interruption—once, say, every minute, on a telephonic circuit—would not produce any effect on the articulation, nor would these momentary interruptions be considered, we presume, to cause the circuit to be no longer considered as a closed one. If we admit that such is the case for momentary interruptions once a minute, we ought, logically, to admit it for momentary interruptions once, in, say, every hundredth of a second. The argument which seems to be advanced, that an intermittent current cannot be an undulatory one is decidedly weak. In the case of a permanently closed circuit, we have undulations passing which may be represented by a *continued* sinuous line; when the interruptions take place, this line becomes a dotted one, but it is none the less a sinuous one, that is of an undulatory form. The word undulatory does not, we contend, necessarily imply continuity. With reference, again, to the term "closed," its obvious technical meaning is, we take it, a circuit which is closed at *some* period or periods of the time during which it is in use. It is, we believe, a generally well-known fact that the interposition of a "condenser" in the receiving portion of a telephonic circuit does not prevent the apparatus from working; indeed, except under certain conditions, it produces no appreciable effect; that is to say, the articulation is quite as loud and clear as it is when the condenser is not used. Such a circuit can hardly be considered a closed one within the general meaning of the term, yet it seems that no one has brought forward this fact as an argument against the soundness of the Bell claims. The action of the telephone may or may not be explainable on the undulatory theory, but we must hold that it requires experiments of a very different character to those hitherto described to prove the actual facts of the case.—*London Electrical Review.*

The net loss in the telephone output of the American Bell Telephone Company for the month ending February 20 was 594, against a net loss of 298 in the previous month, and a gain of 379 in December. Tabulated in comparison with 1884, the figures are:

February.	1885.	1884.
Output	1,958	4,545
Returned	2,552	1,746
Net output	....	2,799
Net loss	594	....

Total loss, February, 1885, over February, 1884, 3,393.

The World's Market Statistics of Copper.

By A. Harnickell, New York.

FINE COPPER IN TONS OF 2240 POUNDS.

1880.	1881.		1882.	1883.	1884.	1885. January.
		Grand total of actual copper commercially handled in 1884, 179,150 tons				
		The market for the sale and purchase of copper for the world, except for the United States, is in England and France; Germany and Russia produce a part of their consumption, but receive some also from the United States and from England.				
		The imports into England and France, from the United States, were	2,000	14,000	25,000	4,400
		The imports into England and France, from Chili, Australia, etc	91,400	96,300	92,500	8,000
		Germany, etc., imported from the United States	600	4,600	6,300	
		Germany, etc., imported from Chili	.....	.....	850	
		English production from pyrites and mines	15,700	15,000	14,000	
		Total supply, as far as it reaches commerce	109,700	129,900	138,650	
		Exports from and consumption in England and France adding also the direct German importations, were:				
102,000	112,000	Used copper tons	113,600	125,100	143,850	
		And the deliveries in France and England, were for January	4,900	5,800	8,300	9,200
		The stock in England and France at the end of the year was	35,000	.....	37,700	

IN THE WESTERN HEMISPHERE.

1876.	1880.					
		All countries except the United States depend on London, and their exports are counted in above imports.				
51,000	43,000	Chili shipped in	43,000	41,000	44,000	My estimate of expectancy,

IN THE UNITED STATES.

	Counted in	Pounds.	Pounds.	Pounds.	1885.
The production was:					
Lake Superior mines		57,000,000	59,000,000	68,500,000	*67,000,000
Montana		9,000,000	24,500,000	37,000,000	†35,000,000
Arizona		17,000,000	22,500,000	23,000,000	25,000,000
Colorado, California, and all others		5,000,000	7,000,000	7,300,000	5,000,000
		88,000,000	113,000,000	135,800,000	
Surplus stock on hand January 1, 1884		.....	.....	23,000,000	
				158,800,000	132,000,000
Home consumption was		77,000,000	80,000,000	70,000,000	76,000,000
		11,000,000	33,000,000	80,800,000	56,000,000
Export of United States copper		4,850,000	39,800,000	77,000,000	
Stock on hand January 1, 1885		.....	.....	11,800,000	Surplus of 1885.
There were also pyrites, etc., imported and re-exported as copper		1,000,000	2,000,000	3,000,000	
The consumption of copper in the United States had increased enormously before 1882, and has not increased since, but will naturally increase again.					
The consumption of Europe and the East has increased in three years by 27 per cent. or by					30,250 Tons
And in five years by 41 per cent.					
The surplus exported from the United States in '84, was:					
Arrived in Europe in 1884			31,300 Tons.		
" " January, 1885			4,400 "		
Total United States exports....77,000,000 pounds.					34,380 "
In 1885, Europe may get only					25,000 "
that is, with Chili bars at about £50; less, if £47 or £45					

*Owners of surviving mines pretend this figure, 75,000,000
†Owners of surviving mines pretend this figure, 55,000,000; another 40,000,000.
These estimates would not come true if Chili bars went to £53.

We publish herewith valuable statistics of copper, compiled by Mr. A. Harnickell, and a very carefully made estimate of copper consumption in Europe, made by Mr. S. Raunheim. Though this estimate is not so agreeable to us as some more cheerful views that have recently been published, yet Mr. Raunheim has unusual facilities for arriving at correct results, and is a most careful and reliable statistician. The announcement that we made last week of a large shipment of copper from an unexpected source, which had affected the price of Chili bars, Mr. Raunheim puts in the definite shape of 4,000 tons of ingots from Japan. If this lot pushed Chili bars to £47, what will be the effect of the further well-authenticated statement that the German Mansfield Company holds 33,000,000 pounds, which, the company despairing of higher prices, will probably be marketed this year?

Should the English buy the Copper Queen, their avowed policy is to greatly increase the output of that concern. In view of such probabilities and figures as Mr. Raunheim gives, it is difficult to preserve a very hopeful view of the immediate future of the copper market.—*Engineering and Mining Journal.*

Mr. C. Fred Hutchinson, one of the most expert telegraphers in this country, has been appointed to the sole charge of all the Baltimore & Ohio lines in Boston, vice E. F. Leighton retired. Mr. Hutchinson was at one time in the employ of the Western Union and was sent by that company to the Pacific coast during the illness of President Garfield. He was also sent to Washington during the Guiteau trial. In 1881 he made a record of sending 75 1-5 messages per hour for five successive hours, a feat that has never been excelled. Since that time he has been night manager of the Mutual Union Company and assistant manager of the Baltimore & Ohio company and his promotion has been richly earned.

Telephone Companies.

In the case of State *vs.* Nebraska Telephone Company, decided on the 21st ult., the Supreme Court of Nebraska held that telephone companies are common carriers of news; that all persons are entitled to equal facilities in the employment of the benefits to be derived from the use of the telephone, and that where no good reason is assigned for a refusal by a telephone company to furnish a telephone instrument to a person desiring to become a subscriber and tendering a full compliance with all the rules established for other subscribers, a writ of mandamus should be issued to compel such company to furnish such person with the necessary instruments. In giving judgment in the case the court said: "The demands of the commerce of the present day make the telephone a necessity. All people, upon complying with the reasonable rules and demands of the commodity, patented as it is, should have the benefits of the new commerce. The wires of respondent pass the office of the relator. Its posts are planted in the street in front of his door. In the very nature of things, no other wires or posts will be placed there while those of respondent remain. The relator never can be supplied with this new element of commerce, so necessary in the prosecution of all kinds of business, unless supplied by the respondent. He has tendered to it all the money required by it from its other subscribers in Lincoln for putting in an instrument. He has proven, and it is conceded by respondent that he is able, financially, to meet all the payments which may become due in the future. It is shown that his office can be supplied with less expense and trouble to respondent than many others which are furnished by it. No reason can be assigned why respondent should not furnish the required instruments, except that it does not want to. There could, and doubtless does, exist in many cases sufficient reason for failing to comply with such a demand, but they are not shown to exist in this case. It is known to be essential to the business interests of relator that his office be furnished with a telephone. The value of such property is of course conceded by respondent, but by its attitude it says it will destroy those interests and give to some one in the same business, who may have been more friendly, this advantage over him. It is said by respondent that it has public telephone stations in Lincoln, some of which are near relator's office, and that he is entitled to and may use such telephone to its full extent by coming there; that, like the telegraph, it is bound to send the messages of relator, but it can as well do it from these public stations; that it is willing to do so, and that is all that can be required of it. Were it true that respondent had not undertaken to supply a public demand beyond that undertaken by the telegraph, then its obligations would extend no further. But as the telegraph has undertaken to the public to send dispatches from its offices, so the telephone has undertaken with the public to send messages from its instruments, one of which it proposes to supply to each person or interest requiring it, if conditions are reasonably favorable. This is the basis upon which it proposes to operate—the demand which it proposes to supply, it has so assumed and undertaken to the public. That the telephone, by the necessities of commerce and public use, has become a public servant, a factor in the commerce of the nation, and of a great portion of the civilized world, cannot be questioned. It is to all intents and purposes a part of the telegraph system of the country, and in so far as it has been introduced for public use, and has been undertaken by the respondent, so far should the respondent be held to the same obligation as the telegraph and other public servants. It has assumed the responsibilities of a common carrier of news. It has and must be held to have taken its place by the side of the telegraph of such common carrier."

Muirhead vs. the Direct United States Cable Company, Limited

The defendant company appealed from the decision of Mr. Baron Huddleston, declaring the company liable for the rent of the plaintiff's duplex system of telegraphing for a certain period during which, in consequence of defects in the cables, the system would not work. Having heard the arguments of the counsel for the defendants that the cables, though slightly defective, would yet carry messages on the simplex system, the Master of the Rolls expressed himself clearly to the effect that the fault was in the company's cable and not in the duplex system, which was now as good as ever, and held that Mr. Baron Huddleston was right in his decision.

Lords Justices Cotton and Lindley concurred, and judgment was given against the appellants.

.... The true inwardness in the move against Mr. Cyrus W. Field in the Anglo-American Cable Company is partially developed. He is one of the smallest holders of stock on record in the list of directors, his total holdings being represented by the sum of just £80. The movement against W. S. Cunard was on the same ground, viz., that he had sold out his stock. The London *Financial News* declares that the directors of the company defeated the expressed will of the stockholders to drop Mr. Field by the use of proxies, given them before the question of his right to retain his seat had been raised.

.... The following resolution was offered in the United States Senate by Senator Gorman of Maryland and at once adopted:

Resolved: That the Secretary of the Interior be directed to inform the Senate whether the Union Pacific Railroad and the other railroad companies affected by the Act approved July 1, 1862, granting subsidies in bonds and lands, have constructed and are maintaining and operating their own lines of telegraph, and whether telegraphic messages are accepted and transmitted for all persons and corporations without discrimination as to price and other conditions as approved in Section 15 of the Act above referred to.

TELEGRAPHIC

.... The completion of the Mackay-Bennett cable makes the total length of submarine cables, according to *The Electrician*, about 68,000 miles. Each cable contains an average of forty strands of wire, so that altogether there are over 2,500,000 miles of wire used in their construction, or about ten times the distance from the earth to the moon. Practically all this has been laid within the last twenty-five years, the greater part within a decade.

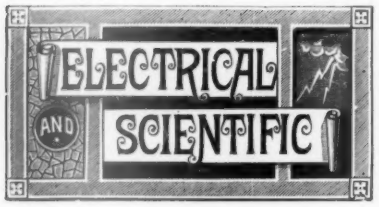
.... In reviewing the situation in the Telephone field our Boston correspondent says that the Clay Commercial Company with the clearest kind of infringement, will get a hearing March 3, and there is little doubt that it will get some information that may be to its intellectual if not its financial advantage. The Clay Commercial case will come up before Judge Butler at Philadelphia on the argument for a preliminary injunction. The claim is simply for an improvement in device. The Clay Commercial has done some work at Philadelphia, Baltimore and in the Middle States. The Molecular company was about to purchase the plant of the Clay company in Cleveland, where some handsome poles at least had been erected.

The Pan Electric company has opened out in Texas and other Western States, and has established an opposition exchange at Fort Worth, which exceeds in the number of subscribers the exchange of the Erie company, operating under the Bell patents. In time these oppositions will all be demolished, but it takes time for legal movements.

The inspiration of all the opposition companies is the very wild idea that telephone exchanges yield a large profit. It could be easily demonstrated that the telephone exchange business yields very little profit, except in large cities and for extra territorial communication.

In New York a preliminary injunction was recently obtained against the United States Telephone Company, operating under the McDonough patents, and this case has to be pressed forward to a final hearing for a permanent injunction.

.... Supt. Walker of the Electrical Department of the city of Philadelphia makes the following report: During the year 737 permits were issued to parties who had obtained the consent of councils for the erection of poles and wires. The telegraph and electric light companies erected 190 new poles, the smallest number for many years. Expensive repairs were made by the department, and lines extended for the erection of new fire signal apparatus. According to the returns made, as required by ordinance, there were on December 31st, 1884, on the highways, 4,631 poles, exclusive of poles along railroad tracks and belonging to the city; 4,490 miles of telegraph and telephone wires; 115 miles of electric light wires and 341½ miles of underground wires. The city has 3,449 poles and 411 miles of wires, making a total overhead of 5,025 miles and 8,080 poles, independent of lines belonging to city departments. There were 12,272 attachments to city poles, supporting 494 miles of telegraph, telephone and electric light wires, for which the city receives annual rental. The license charges amounted to $23,092.95. The amount expended for the extension and improvement of the lines, etc., was $9,818.71, and for repairs and maintenance, $5,000. There were in use at the end of the year 1884, 292 street signal boxes, 38 police instruments, 46 gong instruments, 3,149 telegraph poles, 411 miles of wire. The total number of messages transmitted over the city lines relating to missing persons, lost children, criminals, stolen property, stolen vehicles and horses, fires, policemen summoned to the courts, etc,, was 230,379, being an increase of 19,875 over 1883. There were 466 fire alarms.



* * The man who is curious to see how the world could get along without him can find out by sticking a cambric needle into a mill pond, and then withdrawing it and looking at the hole.

* * A New York inventor has prepared a paint that is said to be proof against the teredo and the white ant. The body is made from nitric acid, zinc, copper and arsenic. It will not meet with a large sale, as the inventor declares it will kill any person who handles it carelessly.

* * In coating zinc with nickel, by means of a galvanic current, the zinc must first be cleaned by diluted hydrochloric acid and thoroughly washed. It is then hung in the nickel bath for a short time, taken out, rinsed, and thoroughly scraped, so as to remove all the metal that does not adhere firmly. This operation is repeated till the zinc is covered with a thin film of nickel, which can afterwards be made as thick as required. The suitable current strength is easily found; and when the zinc is once thoroughly covered, the current may be increased without any risk of the nickel peeling off.

* * For the larcency of a bucket of candy, the value of which could not possible be more than $10, two men were yesterday sentenced by one of our judges to an imprisonment of 18 months each. On the day before a man who pleaded guilty of an embezzlement of $115,000, while occupying a position of trust, was sentenced by another judge to an imprisonment of 32 months—4 months less than combined imprisonment of the two men who committed a petit larceny. Verily, the eyes of justice are bandaged to little purpose in this age of universal discrimination! —*Phi adelphia Record.*

* * Professor Riatti has constructed a thermo-electric cell, based upon the principle that the production of electricity is due to the difference of the temperature of two parts of a single fluid. The cell consists of a receptacle of wood or porcelain, traversed by two tubes of copper, with wires at a certain distance between them. By the principal tube a jet of steam is passed, and by the other cold water. The outer jar contains a solution of sulphate of copper. When the circuit is made, the copper of one of the tubes is dissolved, and is deposited in the other. This cell is said to be constant, and not liable to polarization.

* * A correspondent to the *Timber Trades Journal* says that, to prevent the decay of posts at the level of the ground they should be protected, say 6 in. above and 6 in. below this point, with sheet zinc closely nailed round; and another good plan is to shoe the posts with wood, allowing the shoe to come 6 in. or so above the ground. This offers a larger volume of wood to the action of disintegration at the ground level, and gives the post an extended lease of durability. Though the ordinary charring and tarring are no mean preservatives, it is a popular error to apply these remedies to other points than those of the ground level.

* * We notice the following in one of Mr. Atkinson's papers, read in 1882: "To the workman, or to the workwoman, it matters not what the measure in money is by which their wages or earnings are defined. The real question is, How good a house, how large a room, how adequate a supply of food, fuel and clothing can I purchase with that money? It therefore follows that every application of science to manufacturing industry, to mining, or to agriculture, by which the aggregate of things is increased while the labor is diminished, tends to increase the quantity of commodities to be divided among the laborers; and as this increase is progressive year by year, the proportion which capital can secure to itself under free contract becomes less, while the proportion which is assigned to laborers becomes greater."

(*The Electric Light Convention.—Continued.*)

and every committee had so reported. Mr. Johnson, of Hyde Park, said that in Rockford, by its four lights on top of the Court House, every alley was lighted, and you could read a newspaper anywhere as if by a beautiful moonlight. He was converted to the tower system. Mr. Yarbrough, of Nashville, said in his city posts were put up with arms to them, and during three years not a light had fallen. Mr. Montague of La Crosse, Wis., said the wires across the street had been abandoned, and towers placed at the corner of the streets. The lamps were suspended on posts with iron arms, and the system was satisfactory.

A recess for dinner was taken, a number of the members improving the opportunity by visiting the large establishments of the Western Electric and Van Depoele Companies.

On re-assembling, "Copper-coated and Uncoated Carbons" was considered, George Wadsworth holding that copper-coated carbons were objectionable on the ground of obstruction to the lights and uncleanliness from the work of the trimmer. Mr. Van Depoele favored coated carbons where there was a low electric motive force and large current.

The committee appointed to consider the question of interference between electric light and telephone lines, reported that the question was principally one of construction, wherein both sides had duties. The following was recommended: Telephone lines to have metallic circuits; return electric light circuit to be on the same poles as the outgoing circuit, when possible; care to keep the electric light carefully insulated, and that all joints be soldered; electric light wires be suspended below the telephone wires; telephone companies use cable with induction killer and lightning arresters. The report was adopted.

The report of the Committee on Permanent Organization was then read by the chairman of the committee, Mr. William A. Hovey, of the ELECTRICAL REVIEW. It embodied a plan for a national association of those engaged in the business of manufacturing and operating the electric light in all parts of the country, and submitted a constitution and by-laws for such organization substantially as follows:

ARTICLE I.

The name of this association shall be the National Electric Light Association.

ARTICLE II.

The members of this association shall be companies, firms, or individuals operating electric light plants or manufacturing electric lighting apparatus.

ARTICLE III.

Companies, individuals, or firms engaged in the manufacture of machinery or apparatus connected with electric lighting, may be admitted to associate membership by a vote of the Executive Committee. Such associate members shall pay the same dues as members, shall be entitled to seats at all meetings, but shall have no vote, shall be ineligible to office, and shall be entitled to the floor only at the request of the Executive Committee or presiding officer.

ARTICLE IV.

The officers of this association shall be a President, three Vice-Presidents, a Secretary and Treasurer, who shall be one and the same person, and six other members of the Executive Committee, of which the President, Vice-Presidents, and Secretary and Treasurer shall be members *ex-officio*. Five members shall constitute a quorum. All officers shall be elected by ballot at any regular meeting of this association, and shall hold their respective offices for one year, or until their successors are elected and qualified.

ARTICLE V.

The duties of the several officers shall be those usually pertaining to their offices.

ARTICLE VI.

The Executive Committee shall be the governing body of the association. It shall meet from time to time, gather and prepare information on all topics of interest, and submit reports at each meeting of the association.

ARTICLE VII.

At least one general meeting of the association shall be held each year, at such time and place as the Executive Committee shall determine.

ARTICLE VIII.

The entrance fee shall be ten dollars for each member. Each member may be represented by a number of delegates not exceeding three, and shall be entitled to one vote.

ARTICLE IX.

The constitution may be amended at any general meeting of the association by a vote by ballot of two-thirds of those present.

Officers of the association were elected, as follows: President, J. F. Morrison, Baltimore; Vice-Presidents, H. M. Cleveland, Hartford; J. H. Yarbrough, Nashville: E. R. Weeks, Kansas City; Secretary and Treasurer, William A. Hovey; Executive Committee, George S. Bowen, Chicago; William Hochhausn, New York; Gilbert Donaldson, St. Paul; Frank Ridlon, Boston; John R. Fletcher, Akron, O.; and George O'Connor, New Orleans, and the officers above named.

The newly-elected officers of the national association were duly installed, and President Morrison made a short address, thanking the convention for the honor of selecting him as their permanent chairman, and congratulating them upon the results of a useful, interesting, and harmonious convention.

Mr. George S. Bowen delivered a short farewell address to the assembly, expressing the gratification of the Chicago Committee of Arrangements at the large attendance in response to the call, and also upon the interest taken in the proceedings, closing with the expression of the hope that the "circuit of mutual sympathy and interest that had now been established would never be broken."

Resolutions thanking President Morrison for his impartial discharge of the duties of his position, the Grand Pacific Hotel for its many courtesies, and the press of Chicago for the full and correct reports, were adopted, and the convention adjourned *sine die*.

The Executive Committee held a meeting Thursday evening, and decided to call a meeting some time in July next, the place to be decided hereafter. Circulars will be sent to all members, asking their views on the topics to be discussed and the place preferred for holding the next meeting. The members quite generally favored the East, and New York, Saratoga, Atlantic City, and Put-in-Bay were suggested.

The full stenographic report of the proceedings is in the hands of the Secretary, to be published in pamphlet form and a copy sent to each member.

THE ROSTER.

Those recording their names are given below, although there were a number of gentlemen coming in the last day who failed to place their names on the roll:

J. F. Morrison, Brush Electric Company, Baltimore, Md.; Sommerfield Baldwin, Brush Electric Company, Baltimore, Md.; Theo. P. Bailey, Chicago, Ill.; A. N. Lane, Muskegon, Iowa; R. M. Johnson, Hyde Park, Ill.; J. H. Yarbrough, Nashville, Tenn.; R. T. Robinson, Providence, R. I.; A. L. Ide, Springfield, Ill.; H. M. Cleveland, Schuyler Electric Light Company, Hartford, Conn.; S. E. Locke, Schuyler Electric Light Company, Omaha, Neb.; S. S. Badger, Badger Electric Light Company, Chicago, Ill.; M. C. Bullock, Brush Electric Light Company, Chicago, Ill.; C. J. Richards, Racine, Wis.; F. S. Terry, Electrical Supply Company, Chicago, Ill.; J. H. Reid, Electrical Supply Company, Chicago, Ill.; W. L. Bush, Van Depoele Company, Chicago, Ill.; C. J. Van Depoele, Van Depoele Company, Chicago, Ill.; E. J. O'Beirne, Star Iron Tower Company, Ft. Wayne, Ind.; W. A. Knapp, Railway Telegraph Supply Company, Chicago, Ill.; W. T. Lewis, Thomson-Houston Company, Racine, Wis.; F. H. Angell, American Electrical Works, Providence, R. I.; C. C. Curtis, Brush Company, Cleveland, Ohio; E. D. Libbey, New England Glass Company, Boston; J. D. Robinson, New England Glass Company, Chicago; Geo. D. Fletcher, Van Depoele Company, Dixon, Ill.; Elmer A. Sperry, Sperry Electric Light Company, Chicago, Ill.; Edwin Place, Sperry Electric Light Company, Chicago, Ill.; Chas. E. French, Cleveland Carbon Company, Cleveland, Ohio; R. J. Randolph, Rockford, Ill.; W. T. Powers, Grand Rapids Electric Light Company, Grand Rapids, Mich.; Geo. W. Carter, Van Depoele Company, Jackson, Mich.; E. T. Keim, United States Electric Light and Power Company, Dubuque, Iowa; C. B. Askew, St. Paul Electric Works, St. Paul, Minn.; Joseph Fleisheim, Electric Light Company, Menomonee, Mich.; Geo. L. Crossman, Thomson-Houston Electric Light Company; D. Jacobus, Van Depoele Company, Crookston, Minn.; E. M. Fox, E. Remington & Sons, Ilion, N. Y.; F. M. Mills, Thomson-Houston Company, Des Moines, Iowa; E. R. Montague, Brush Company, La Crosse, Wis.; H. C. Adams, Holmes, Booth & Hayden, New York; A. W. McLaughlin, Holmes, Booth & Hayden, New York; R. L. McDonald, Jenney Electric Company, Ft. Wayne, Ind.; Vernon Bell, Western Electric Company, Minneapolis, Minn.; Harold P. Brown, Chicago, Ill.; Wm H. Beach, Olmstead Electric Light Company, Minneapolis, Minn.; T. P. Plumridge, American Carbon Company, Chicago, Ill.; W. M. Goldthwaite, Electric Light Company, La Porte, Ind.; W. M. Goldthwaite, Electric Light Company, Adrian, Mich.; Albert L. Avery, Buffalo Electric Works, Buffalo; H. D. Stanley, Bridgeport Electric Light Company, Bridgeport, Conn.; Wm. A. Hovey, ELECTRICAL REVIEW, New York; Charles W. Price, ELECTRICAL REVIEW, Chicago; G. W. Parker, Parker-Russell Manufacturing Company, St. Louis, Mo.; L. M. Fishback, Parker-Russell Manufacturing Company, St. Louis, Mo.; W. Hochhausen, New York; John C. Fyfe, Nee Bau Electric Light Company, Chicago; W. A. Hammett, New York Safety Steam Power Company, Chicago; Frank Stewart, Western Electric Company, Chicago; Chas. A. Brown, Western Electric Company, Chicago; George S. Bowen, Elgin Electric Light Company, Elgin, Ill.; W. H. Boulton, Boulton Carbon Company, Cleveland, O.; Geo. H. Wadsworth, Boulton Carbon Company, Cleveland, O.; E. R. Weeks, Thomson-Houston Electric Light Company, Kansas City, Mo.; Aaron K. Stiles, Van Depoele Company, Chicago; W. A. Kreidler, Correspondent, Chicago; Frank Ridlon, Brush Electric Light Company, Boston; R. T. McDonald, Jenney Electric Light Company, Ft. Wayne, Ind.; C. C. Warren, United States Electric Light Company, Chicago; W. J. Buckley, Excelsior Electric Light Company, Chicago; E. M. Barton, Western Electric Company, Chicago; John Young, Western Electric Company, Chicago; C. C. Haskins, Western Electric Company, Chicago; C. A. Cotter, Ansonia Brass and Copper Company, Chicago; W. P. Hathaway, Fuller Electric Light Company, Milwaukee; W. F. Walworth, Manufacturing Electric Light Crossarms, South Bend, Ind.; J. C. Neville, Manufacturing Electric Light Crossarms, South Bend, Ind.; E. B. Palmer, Sperry Electric Light Company, Chicago; H. L. Brintnell, Swift Electric Light Company, Saginaw, Mich; J. H. Stanwood, Badger Electric Light Company, Chicago; L. W. Slack, Pittsburgh Carbon Company, Pittsburgh, Pa.; Elisha Gray, Chicago; H. W. Burgett, American Electrical and Illuminating Company, Boston, Mass.; Gilbert Donaldson, Electric Light Company, St. Paul; W. H. Keasel, Willoughby, Hill & Co., Chicago; D. R. Russell, Parker, Russell & Co., St. Louis, Mo.; John R. Fletcher, Dayton Electric Light Company, Dayton, Ohio; C. H. Webster, Chicago; J. D. Simpson, Chicago.

The American Telephone and Telegraph Company was incorporated at Albany, N. Y., on Thursday last. The incorporators are Edward J. Hall, Jr., Thos. B. Doolittle, J. P. Davis, and A. S. Dodd.

The Dangers of Mechanical Generators of Electricity.

By M. A. D'Arsonval.

The more and more general use of powerful electro-magnetic generators has caused several accidents, some of them involving the loss of human life. It is, therefore, desired at present to regulate the employment of electricity, and to determine experimentally the tension and the intensity which are dangerous in practice.

The problem thus set forth is not well put and is not susceptible of any solution, as the object of the present communication is to show. In the first place, it is not, generally, when the electric current is permanently established that accidents take place, but at the moment of the establishment or of the rupture of the electric circuit. Under these circumstances, the body of the experimentalist re-establishes for a longer or shorter time the continuity of the broken circuit. It is easy to show that at this moment the danger incurred depends by no means on the tension and the intensity of the primitive current, as is generally believed, but depends on quite a different factor, which cannot be calculated from a mere knowledge of the tension and the intensity of this primitive current.

All physiologists know that the energy of an electric excitement depends much less on he intensity of the current than on the rapidity of the fall of the potential and on the frequency of the shocks.

This being established, the following propositions become, so to speak, self-evident:

Proposition I. A battery and a machine producing in a rectilineal circuit two currents having the same intensity and the same tension, do not present the same dangers.

In fact, if we break the circuit in any point whatever, holding in each hand an end of the uninsulated wire, we find that the battery gives scarcely a shock, whilst the machine produces a much more considerable excitement of the nervous and muscular systems—an excitement which in certain cases may become instantaneously fatal. The reason of this difference is that the battery in a rectilineal circuit does not give an extra current, whilst the machine, by the mere fact of its construction, gives one, the power of which varies with the length and the manner of coiling of its circuit, as well as with the quantity of iron which forms its framework. The danger, therefore, resides simply in the power of the extra current resulting from the self-induction of the generator.

From these very simple considerations, the results of experience, we deduce the following propositions:

Proposition II. Two machines yielding currents of the same intensity and the same tension in a similar circuit may be unequally dangerous, since their coefficients of self-induction, and consequently their extra currents, may be very different.

Proposition III. A current not dangerous in one circuit may be dangerous in another. It is merely necessary to give the circuit a self-induction by any means whatever—*e. g.*, by the interposition of an electro-magnet.

I have verified experimentally these theoretical deductions by operating upon Guinea pigs with a Gramme machine (laboratory model) and with accumulators. The tension of the currents employed varied only from 2 to 20 volts, and the intensity from 1 to 30 amperes. Notwithstanding the feebleness of the currents employed, the Guinea pigs were nevertheless killed. We see, therefore, that, if we wish to suppress all danger in the use of electricity, we arrive at the absurd conclusion that electricity itself must be suppressed.

I have sought for a remedy for this state of things. This is the method which has proved efficacious in all cases, and which constitutes a general procedure for the suppression of extra currents.

To avoid all danger, what, in short, must be done? Simply prevent the extra current from traversing the body of the experimentalist. We know that the tension of the exra current is infinitely greater than that of the primitive current from which it takes its rise.

This being admitted, I place in derivation at the extremities of the electric generator a series of voltameters, with lead plates and acidulated water, in such a number that their electromotive force of polarization may be superior to the maximum electromotive force of the machine. This derivation is absolutely impassible by the direct current, whilst the extra current traverses it readily. At the moment when the circuit is broken the extra current passes through the voltameters, and the human body is absolutely secure.

This is a general and very simple method for the suppression of extra currents. It admits of numerous applications, some of which I have already carried out, but their explanation cannot be given in this brief notice. I take voltameters with leaden plates because they develop practically the greatest electromotive force, and I vary the arrangement according to circumstances.

We see that the process which I propose consists in the establishment of a derivation, insurmountable for a direct current, and consequently occasioning no waste of current. This derivation exists only for the extra current. It is analogous to a safety valve, which opens automatically at a given pressure.—*Comptes Rendus.*

—— The electric light, in the Paris Opera, has given excellent results, and the management propose to adopt it for the grand *bals masques*. The most noteworthy of electric light installations in the public streets of Paris is that of the Place du Carrousel. Ten tall candelabra, curved at the top, carry pulleys on which work the cords for suspending the Lontin lamps. Both the cords and the conductors are wound on a winch for raising the lamps to a height of eight meters, or 26 feet. Two other lamps, on the Mersanne principle, with horizontal carbons, are mounted on a central column at a height of 20 meters, or 65 feet. All the lamps are provided with reflectors, which throw the rays downwards. The dynamos, driven by a 35 horse-power steam engine, are placed in a temporary pavilion.

—— The following is a list of the sub-companies of the American Electric and Illuminating Company in operation, and the number of lamps run by each:

	No. of arc lamps run.
Merchants' Electric Light and Power Company, Boston	495
Union Electric Light and Power Company, East Boston, etc	100
Middlesex Electric Light Company, Lowell, Mass	300
Wachusett Electric Light Company, Fitchburg, Mass	140
Narragansett Electric Light Company, Providence, R. I	200
Hartford Electric Light Company, Hartford, Ct	250
*Worcester Electric Light Company, Worcester, Mass	250
Lewiston & Auburn Electric Light Company, Lewiston and Auburn, Me.	150
Lynn Electric Lighting Company, Lynn, Mass	150
Salem Electric Lighting Company, Salem, Mass	75
New Bedford Electric Light Company, New Bedford, Mass	113
Fall River Electric Light Company, Fall River, Mass	131
Essex Electric Company, Haverhill, Mass	100
Woonsocket (R. I.) Electric Machine and Power Company	36
Pawtucket (R. I.) Electric Light Company	50
New Haven (Ct.) Electric Light Company	154
Bridgeport (Ct.) Electric Light Company	175
Quincy Electric Light Company, Brockton, Mass	50
Consolidated Electric Light Company, Portland, Me	200
Sub-company of same at Old Orchard, Me	50
Gloucester Electric Light Company, Gloucester, Mass	55
Pittsfield (Mass.) Electric Light Company	50
North Adams (Mass.) Electric Light Company	50
Sub-company of Lewiston & Auburn Company, Bar Harbor, Me	50
Total of arc lamps in sub-company stations	3,474

*At Worcester 50 more lamps are being added.

—— Electric lighting for the dining-room of the coming Inventors' Exhibition is to be furnished by the Bernstein Electric Lamp Co.

—— The new Montezuma Hotel at Las Vegas, New Mexico, is putting in the United States Incandescent Lights to be run by two 50 horse-power Westinghouse Automatic Engines.

—— The Mobile Electric Light Company, Mobile, Ala., have ordered the Jarvis patent furnace for their new tubular boiler. They will also use the Sheffield grate bars in putting in their new plant.

—— The electric lighting on board the new cable steamer "Electra" consists of 105 20 candle power Edison-Swan incandescent lamps, five arc light, and one powerful search light on bridge, with reflector.

—— The Municipal Electric Light Company, of Brooklyn, N. Y., of which Mr. Charles Cooper is president and Mr. G. M. De Mund general manager, has already put in operation 140 arc lamps, and expect, by the time their new station is completed, to have 250 running.

—— The Westinghouse Machine Company, of Pittsburgh, report trade as opening remarkably active in 1885. Their sales for the month of January were 67 engines, aggregating 1,752 horse-power, which is certainly good for hard times. The electric light industry still continues to furnish plenty of business. Besides a large number of engines for lighting private establishments they have contracted for the following public stations: The Newton Electric Light Company, of Newton, Iowa, one Westinghouse Automatic Engine of 35 horse-power; the Champion Electric Light Company of Springfield, Ohio, engines of 60 horse-power each; the Excelsior Electric Light Company of Port Huron, Mich., one 60 horse-power Westinghouse automatic engine; the Northwestern Electric Light and Power Company, of Omaha, Neb., one engine of 45 horse-power; the Weston Electric Light Company, Lexington, Ky., one 80 horse-power engine, being the second one within two years; the Brush Electric Light Company, of Buffalo, N. Y., also order two more engines of 65 horse-power each, making twelve Westinghouse engines in all, which are running in their principal stations.

—— Supt. Walker, says that the question of lighting the borough of Bethlehem, Pa., with electricity is one that has been discussed for some time and various opinions have been expressed on it. While many were strongly in favor of it there were also those who were just as strongly opposed to it. A citizens' meeting was held in that borough some few months ago for the express purpose of learning the wish of the people upon the important question which was then at issue. No definite conclusion could be arrived at, and discussion on the matter was at a standstill for a time. As one after another of the electric lights on Main street were taken down the prospects for the electric light company appeared rather dismal. But "every cloud has a silver lining," and when the question again came before the town council a ray of hope sprang up when that body decided to leave it to a vote of the people as to whether or not Bethlehem should be lit by electricity. The question is no longer at issue, but has been definitely settled. The people of Bethlehem yesterday showed by their vote that they believe in improvements, and what greater improvement could be made by any borough than to decide to light its streets by electricity. The majority in favor of it is 600, and it will be but a short time before the streets of Bethlehem will be lighted by the rays from the electric lamps. Since this victory has been won in Bethlehem we look for South Bethlehem to take the same step. The advantages of lighting any town by electricity have been discussed before in these columns and are so well known that it is not necessary for us to enter into another discussion at present, but hope that the time is not far distant when South Bethlehem will follow the example of its sister town and our streets at night will be lit by electricity.

Business Notice.

A. L. Bogart, Electrician, No. 22 Union Square New York, manufacturer and sole owner of Letters Patent and licenses controlling every variety of electric gas lighting apparatus for churches, theaters, public and private buildings, having by long experience and persistent effort acquired the best known system of constructing as well as of applying the varied apparatus used in the lighting of gas jets by electricity, has secured for them an admission of superiority, and an almost unlimited demand, resulting in the employment of improved machinery, tools and skilled workmen, and the production of a vast variety of apparatus, both faultlessly and economically made.

The trade procure almost every article required in the electric line from Mr. Bogart at less than the same would cost to manufacture in limited quantities. Prices are based on a living profit only, above actual cost. Royalties on patent rights are not considered.

The attention of the trade and of consumers is respectfully called to the subjoined list of patents issued or assigned to or controlled exclusively by A. L. Bogart. The validity of the patents marked thus (*) has been confirmed by decrees of Judge Addison Brown, of the U. S. Circuit Court for the Southern District of New York, December 25, 1884:

LIST OF THE BOGART PATENTS.

Multiple Gas-Lighting Apparatus.

No. 93,563 Aug. 10, 1869, H. J. Smith, Frictional Machine.

No. 119,561 Oct. 3, 1871, A. L. Bogart, Glass or Porcelain Insulation in a Gas-Burner.

No. 194,328 Aug. 21, 1877, A. L. Bogart, Lava as an Insulator in a Burner.

No. 199,676 Jan. 29. 1878, A. Wright, Wire Electrode Carried by a Lava Tip.

Single-Hand Gas-Lighting Apparatus.

*No. 116,054 June 20, 1871, Heyl & Diehl, Combination of Cock, Movable and Fixed Electrodes in a Gas-Burner.

*No. 146,953 Jan. 27, 1874, A. T. Smith, Hand-Lighter operated by Stop-Cock.

No. 152,427 June 23, 1874, A. T. Smith, Vibrator Burner.

No. 177,459 May 6, 1876, A. L. Bogart, Cock Burner and Method of Insulation.

*No. 180,832 August 8, 1876, A. L. Bogart, Use of Pendant, Wire or Chain to operate spark-producing Electrode in a Hand Burner.

No. 180,833 August 8, 1876, A. L. Bogart, Cork-Burner.

No. 202,694 April 23, 1878, A. L. Bogart, Fixed Arm Burner.

No. 203,406 May 7, 1878, A. L. Bogart, Insulation of Fixed Electrode by Collar on Lava Tip.

No. 206,272 July 23, 1878, A. T. Smith, Pivoted Bar Electrode.

No. 209,016 Oct. 15, 1878, A. L. Bogart, Automatic Burner.

*No. 225,971 March 2, 1880, H. F. Packard, the Original Ratchet Pendant Burner.

No. 259,267 June 6, 1882, A. L. Bogart, Automatic Burner.

No. 279,634 June 19, 1883, A. L. Bogart, Automatic Circuit Cut-off.

No. 282,043 July 31, 1883, A. L. Bogart, Candle Pendant Burner.

No. 290,732 Dec. 25, 1883, A. L. Bogart, Automatic Circuit Cut-off.

No. 292,732 Feb. 5, 1884, A. L. Bogart, Automatic Circuit Cut-off.

No. 292,786 Feb 5, 1884, A. L. Bogart, Automatic Gas-Lighting Attachment for Burglar Alarms.

No. 306,128 Oct. 4 1884, A. L. Bogart, Cock Burner.

*No. 7,249 Aug. 1, 1876, A. T. Smith, Reissue of No. 146,953.

Also for the States of New York, New Jersey and Pennsylvania.

No. 121,301 Nov. 28, 1871, J. P. Tirrell, Automatic Burner.

No. 121,302 Nov. 28, 1871, J. P. Tirrell, Automatic Burner.

No. 230,567 July 27, 1880, G. F. Pinkham, Hand-Lighter.

No. 230,589 July 27, 1880, J. P. Tirrell, Automatic Burner.

*No. 230,590 July 27, 1880, J. P. Tirrell, Automatic Burner.

All parties are hereby notified that infringers will be prosecuted for manufacturing, selling, or using any gas-lighting apparatus covered by the foregoing list of patents, not obtained of A. L. Bogart or of his authorized agents.

March 1, 1885. A. L. Bogart.

—— The grounds of the coming Inventors' Exhibition, which is to be held in London, are to be lighted by electricity by Messrs. Siemens.

—— The Armington & Sims Engine Company, Providence, R. I., have decided to make another size engine to supply the demand from Electric Light Companies. They have had a large demand from parties for direct-acting engines to run 50 arc lamps from two 25-light dynamos. They will now make an engine two 30-light dynamos. It will be 10½" diameter by 12" stroke making 275 revolutions per minute. Fly wheel 47" in diameter, and indicating 60 H. P.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEBRUARY 24, 1885.

312,660 Galvanic Therapeutic Apparatus; Theodore Schmauser, Allegheny, Pa.

312,670 Combined Telegraphic Relay and Telephone; Henry C. Strong, Chicago, Ill., assignor of eleven-fifteenths to David A. Strong, and Henry P. Caldwell, both of same place.

312,673 Electrical Conductor; Colin M. Thompson and Charles R. Eberle, Brooklyn, N. Y.

312,698 System of Electric Lighting by Secondary Batteries; Alexander H Bauer, Baltimore, Md., assignor to the Viaduct Manufacturing Company, of Baltimore, same place.

312,745 Dynamo-Electric Machine; William M. Mordey, Putney, County of Surrey, England.

312,755 Cable Hanger; Wm. R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

312,802 Secondary Battery; Charles S. Bradley, Yonkers, assignor to the Bradley Electric Power Company, New York, N. Y.

312,803 Electrical Conducting Material; Charles S. Bradley, Yonkers, assignor to the Bradley Electric Power Company, New York, N. Y.

312,807 Armature for Dynamo Electric Machines; C. F. Brush, Cleveland, Ohio.

312,831 Repeater for Submarine Cables; Moses G. Farmer, Newport, R. I.

312,841 Telephone; William Hadden, Brooklyn, N. Y.

312,842 Telephone; William Hadden, Brooklyn, N. Y.

312,843 Telephone Switch; Wm. Hadden, Brooklyn, N. Y.

312,871 Battery Telephone; Thomas D. Lockwood, Malden, Mass.

312,896 Telephonic Apparatus; Charles A. Randall, Brooklyn, N. Y., assignor by mesne assignments to the National Improved Telephone Company.

312,899 Fire Extinguishing Apparatus; William A. Reid, St. Louis, Mo., assignor to the N. O. Nelson Manufacturing Company, same place.

312,939 Electric Fire Engine System; Schuyler S. Wheeler, New York, N. Y., assignor to Charles A. Cheever, trustee, same place.

312,948 Apparatus for Rectifying Spirits and Spirituous Liquors by Electricity; Thos. E. Atkinson, San Francisco, Cal.

312,985 Automatic Cut-out for Electric Apparatus; James Du Shane, South Bend, Ind.

313,006 Electric Arc Lamp; Mirabeau N. Lynn, Rising Sun, assignor by mesne assignments to the American Electric Headlight Company, Indianapolis, Ind.

313,009 Electic Lamp for Locomotives; Mirabeau N. Lynn, Rising Sun, assignor by mesne assignments to the American Electric Headlight Company, Indianapolis, Ind.

313,039 Focusing Electric Arc Lamps; Leonidas G. Wooley, Indianapolis, Ind., assignor to the Ohio Power and Light Company, Dayton, Ohio.

313,040 Fire Alarm Signal Box; John Young, Chicago, Ill., assignor to Western Electric Company, same place.

REISSUES.

10,563 Electric Conductor; Wm. R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

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